

GAO

United States General Accounting Office

Report to Congressional Committees

June 1995

WEAPONS ACQUISITION

Precision Guided Munitions in Inventory, Production, and Development

ADA 296 148



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Memorandum

Date: July 18, 1995

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From: *for* Director, NSIAD/SDP - Louis J. Rodrigues *Ray Durkin*

Subject: Reprint of GAO/NSIAD-95-95

Attached is a reprinted version of our report entitled Weapons Acquisition: Precision Guided Munitions in Inventory, Production, and Development (GAO/NSIAD-95-95, June 23, 1995). Please destroy the copies of this report you previously received, as they contain errors on pages 20-22 and 24.

AD-A 398142

**National Security and
International Affairs Division**

B-260458

June 23, 1995

Congressional Committees

The military services are spending billions of dollars to acquire new and improved munitions whose technical sophistication allows guidance corrections during their flight to the target. These weapons are referred to as precision guided munitions (PGM). We reviewed Air Force, Navy, and Army munitions programs in inventory, production, and development that could be defined as using precision guidance to attack surface targets.¹ Our objectives were to determine (1) the costs and quantities planned for the PGMS, (2) the services rationale for initiating PGM development programs, (3) options available to the services to attack surface targets with PGMS, and (4) the extent to which the services are jointly developing and procuring PGMS. We conducted this work under our basic legislative responsibilities and plan to use this baseline report in planning future work on Defense-wide issues affecting the acquisition and effectiveness of PGMS. We are addressing the report to you because we believe it will be of interest to your committees.

Background

PGMs employ various guidance methods to enhance the probability of hitting the target. These include target location information from a human designator, global positioning system (GPS) satellites, an inertial navigation system, a terminal seeker on the munition, or a combination of these sources. Since PGMS can correct errors in flight, the services expect to need fewer rounds to achieve the same or higher probabilities of kill as unguided weapons. Additionally, the services expect PGM accuracy and lethality to reduce the number of launch platforms and soldiers required to counter specific targets. PGMS that can be launched outside the targets' defenses (i.e., with a standoff capability) could enhance the survivability of the launch platforms and personnel. Some PGMS, such as the High-Speed Anti-Radiation Missile (HARM), are optimized for a particular target (radar emitters); others, such as the Joint Direct Attack Munition (JDAM), can be used against a wider variety of targets, such as buildings and tanks.

In selecting munitions for review, we considered only munitions that (1) are surface-to-surface, indirect fire weapons or are air-to-surface weapons and (2) have a nominal standoff from their launching platform of about 5 nautical miles or more. The munitions selected are not the total

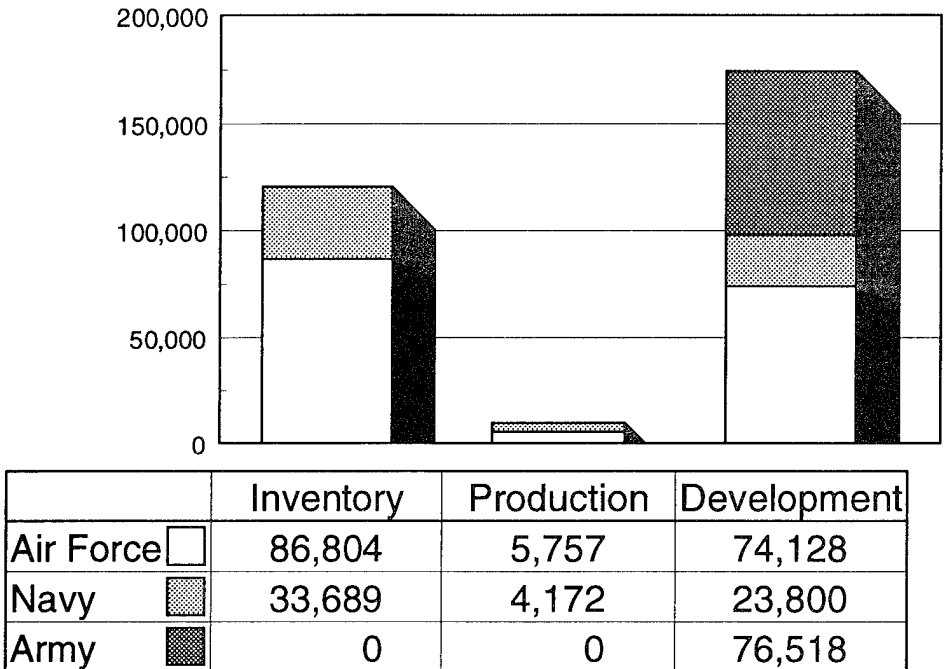
¹Surface PGM targets can be classified as either mobile, fixed, or on the surface of the sea. Targets may be further classified according to whether or not they are specially protected with armor or concrete or emit heat, light, or radar signatures.

universe of precision guided munitions but are those that, in our judgment, represented the substantial majority of the services' PGM investment and capability.

Results in Brief

The military services have bought or are developing for future procurement 33 PGM types with over 300,000 individual precision munitions to attack surface targets. The services estimate that when planned development and procurement are complete, the United States will have invested about \$58.6 billion (then-year dollars) in the 33 PGM types. The 19 munition types in inventory and production provide about 130,422 individual munitions at a cost of about \$30.4 billion. They are carried on Air Force bombers and fighters and on Navy fixed-wing aircraft, helicopters, and ships. The 14 munition types in development have a combined estimated acquisition cost of about \$28.2 billion and quantities of about 174,446. In addition to the Air Force and Navy platforms cited above, some of these munitions are to be launched from Army platforms, such as the Multiple Launch Rocket System launcher. The developmental munitions are expected to reach first capability (i.e., when the services plan to begin fielding them) between 1996 and 2004. Figure 1 shows the allocation of quantities by service in inventory, production, and development.

Figure 1: Munitions Quantities by Service



The services have initiated PGM development programs both to increase the number of PGMS and to gain additional capability through technical improvements, such as the addition of guidance information from GPS satellites, autonomous target acquisition, and standoff range. For example, the JDAM, a joint development by the Air Force and the Navy, is expected to provide the services with an additional 74,000 PGMS. JDAM will incorporate GPS technology with existing 1,000 and 2,000 pound dumb bombs to allow the munitions to guide themselves to the target area. Similarly, the Army Tactical Missile System (ATACMS) with the Brilliant Antiarmor Submunition (BAT) is expected to provide Army forces with 1,806 missiles for attacking targets in the deep battle arena. The missile will use GPS technology to locate the target area while the submunitions will use acoustic, infrared and millimeter wave technology to locate specific targets.

The services have also acquired PGMS to provide an interim capability. As an illustration, Navy and Air Force officials stated they originally planned only small procurements of AGM-142 (Have Nap), the Standoff Land Attack

Missile (SLAM), and the SLAM-Expanded Response (SLAM-ER) because they were interim systems to the Tri-Service Standoff Attack Missile (TSSAM). When procurement and development are complete, the Air Force and the Navy estimate they will have spent about \$1.9 billion and will have 897 munitions—130 AGM-142S, 700 SLAM-ERs, and 67 SLAMs.² According to a Navy official, the SLAM and SLAM-ER could also be deployed on Air Force aircraft that use the Harpoon missile. The Air Force currently uses the Harpoon on its B-52 bombers; therefore, it may be possible to integrate SLAM and SLAM-ER on Air Force bombers. However, the Air Force did not buy any of the SLAM missiles nor according to Navy and Air Force officials does it plan to purchase the SLAM-ER.

The 33 PGM types provide the services with multiple options for countering targets in the five air-to-surface and surface-to-surface target classes, as shown in table 1. The total for all target classes exceeds 33 because 26 of the 33 PGM types have capabilities in more than one target class.

Table 1: Number of PGM Options by Target Class for Munitions in Inventory, Production, and Development

Target class	Examples of targets	Number of PGM options			Total
		Inventory	Production	Development	
Mobile hard	Tanks, artillery, armored personnel carriers	6	1	8	15
Mobile soft	Trucks, vans, mobile missile launchers, unprotected personnel, motorized transport vehicles	2	3	8	13
Fixed hard	Bridges, port facilities, hardened aircraft shelters, underground command posts, bunkers	7	5	6	18
Fixed soft	Factories and manufacturing sites, general purpose buildings, roads, rail yards	9	4	9	22
Maritime surface	Ships at sea	5	2	5	12

The Navy and the Air Force have jointly procured PGMs and are currently participating in joint development programs. For example, the Navy and the Air Force have bought variants of the Air Force-developed Maverick and the Guided Bomb Units (GBU) 10, 12, and 24. The Air Force bought both the Navy-developed HARM and Harpoon missile. We note that the Air Force and the Navy are participating in two congressionally directed joint developments—JDAM and the Joint Standoff Weapon (JSOW). We also

²The quantities for these or other PGMs may increase because the TSSAM program is being terminated due to significant development difficulties and growth in its expected unit cost.

observe, however, that even though JDAM and JSOW are joint programs, the Navy does not plan to buy the JDAM product improvement nor does the Air Force plan to buy the JSOW/Unitary variant. Office of the Secretary of Defense and military service officials informed us that current budgetary constraints have encouraged them to more fully consider joint development and procurement.

Appendix I provides details of acquisition cost, production unit cost, and quantities for the 33 PGM types; the PGM types planned for various platforms; and the specific munition options for countering targets in the five surface target classes. Appendix II provides a brief description of the 33 munitions and program data.

Agency Comments and Our Evaluation

In commenting on a draft of this report, the Department of Defense stated that because the report does not contain findings, conclusions, or recommendations, it was not taking a position on the report but did note the report's contribution to the overall database. The Department commented that the scope of the report was broad, it addresses weapons programs from the Vietnam War into the 21st century, and during this period budgets, priorities, missions, and threats all have seen change. Therefore, any conclusions drawn by comparison of various programs, to be valid, would have to be done carefully to reflect changing conditions.

We agree that the development and production of the 33 PGM types extend over a long period of time and changes have occurred since some of the munitions in inventory were initially acquired. However, all of the PGM types in inventory that we reviewed are still in the active inventory. The first capability dates are included in the program data in appendix II. The Department's comments are included in appendix IV.

Appendix III sets forth the scope and methodology of our work. We are sending copies of this report to the Secretaries of Defense, the Army, the Navy, and the Air Force; and the Director, Office of Management and Budget. We will also make copies available to others upon request.

Please contact me at (202) 512-4841 if you or your staff have any questions concerning this report. Major contributors to this report are listed in appendix V.

A handwritten signature in black ink, appearing to read "Thomas Schuyler for". The signature is fluid and cursive, with the word "for" written in a smaller, simpler script at the end.

Louis J. Rodrigues
Director, Systems Development
and Production Issues

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Abbreviations

AGM	Air-to-ground Guided Missile
APAM	Anti-personnel, anti-materiel
ATACMS	Army Tactical Missile System
BAT	Brilliant Anti-Armor Submunition
CALCM	Conventional Air-Launched Cruise Missile
EFOG-M	Enhanced Fiber Optic Guided Missile
GAM	Global Positioning System Aided Munition
GBU	Guided Bomb Unit
GPS	Global Positioning System
HARM	High-Speed Anti-Radiation Missile
INS	Inertial Navigation System
JDAM	Joint Direct Attack Missile
JSOW	Joint Standoff Weapon
MLRS	Multiple Launch Rocket System
OSD	Office of the Secretary of Defense
P ³ I	Preplanned product improvement
PGM	precision guided munition
SADARM	Sense and Destroy Armor Munition
SFW	Sensor Fuzed Weapon
SLAM	Standoff Land Attack Missile
SLAM-ER	SLAM-Expanded Response
TASM	Tomahawk Anti-Ship Missile
TBIP	Tomahawk Baseline Improvement Program
TLAM	Tomahawk Land Attack Missile
TSSAM	Tri-Service Standoff Attack Missile

Precision Guided Munitions Acquisition

The services have bought or plan to develop and buy over 300,000 individual munitions to defeat surface targets. The 33 precision guided munition (PGM) types we reviewed provide the services with multiple options for defeating targets in each of five target classes—mobile hard, mobile soft, fixed hard, fixed soft, and maritime surface. The services have initiated PGM development programs, both to increase the number of PGMS and to gain additional capability through technological improvements.

PGM Quantities and Cost

According to Department of Defense estimates, the 33 PGM types included in our review represent an investment of about \$58.6 billion in then-year dollars. Table I.1 provides acquisition cost, production unit cost, and quantities for the munitions programs in our evaluation and table I.2 provides platform information.

Table I.1: Precision Guided Munitions: Acquisition Cost, Production Unit Cost, and Quantities

Then-year dollars

Systems	Service	Acquisition cost (dollars in millions)	Production unit cost	Quantity
Systems in inventory				
Conventional Air-Launched Cruise Missile (CALCM)	Air Force	^a	^a	^a
Guided Bomb Unit-10 (GBU-10)	Air Force and Navy	\$271.34 ^b	\$23,700	11,329
Guided Bomb Unit-12 (GBU-12)	Air Force and Navy	620.23 ^b	19,000	32,636
Guided Bomb Unit-15 (GBU-15)	Air Force	774.50	207,651	2,823
Guided Bomb Unit-24 (GBU-24)	Air Force and Navy	729.14 ^b	55,600	13,114
Guided Bomb Unit-27 (GBU-27)	Air Force	176.72 ^b	55,000	3,213
Harpoon	Navy and Air Force	3,203.00	474,609	6,073
High-Speed Anti-Radiation Missile (HARM)	Navy and Air Force	6,212.60	283,985	19,607
Maverick D/G	Air Force	3,063.50	122,230	23,689
Maverick E/F	Navy	653.00	152,491	4,115
Penguin	Navy	241.70	1,566,000	101
Tomahawk Anti-Ship Missile (TASM)	Navy	1,860.80	2,553,000	593
Walleye	Navy	372.00	92,188	3,200
Subtotal		18,178.53		120,493
Systems in production				
Air-to-Ground Guided Missile-130 (AGM-130)	Air Force	635.96	884,279	502
Air-to Ground Guided Missile-142 (AGM-142, Have Nap)	Air Force	200.70	1,020,000	130
Guided Bomb Unit-28 (GBU-28)	Air Force	18.20	145,600	125
Sensor Fuzed Weapon (SFW)	Air Force	1,827.10	319,880	5,000

(continued)

**Appendix I
Precision Guided Munitions Acquisition**

Then-year dollars

Systems	Service	Acquisition cost (dollars in millions)	Production unit cost	Quantity
Standoff Land Attack Missile (SLAM)	Navy	1,138.80	1,378,000	767
Tomahawk Land Attack Missile C/D (TLAM)	Navy	8,426.80	2,115,000	3,405
Subtotal		12,247.56		9,929
Systems in development				
Air-to-Ground Guided Missile-130C (AGM-130C)	Air Force	11.50 ^c	^c	^c
Army Tactical Missile System Block IA (ATACMS Block IA)	Army	828.30	915,000	800
Army Tactical Missile System Block II/Brilliant Anti-armor Submunition (ATACMS Block II/BAT/BAT P ³ I)	Army	3,979.30	2,200,000	1,206
Army Tactical Missile System Block IIA/Brilliant Anti-armor Submunition Preplanned Product Improvement (ATACMS Block IIA/BAT P ³ I)	Army	1,312.36	1,478,967	600
Enhanced Fiber Optic Guided-Missile (EFOG-M)	Army	289.70 ^c	^c	300 ^c
Global Positioning System Aided Munition (GAM)	Air Force	29.60	231,250	128
Joint Direct Attack Munition (JDAM)	Air Force and Navy	4,650.60	56,141	74,000
Joint Direct Attack Munition Product Improvement Program (JDAM PIP)	Air Force	76.50 ^d	^d	5,000 ^d
Joint Standoff Weapon/Baseline (JSOW)	Navy and Air Force	3,327.60	246,585	11,800
Joint Standoff Weapon/BLU-108 (JSOW/BLU-108)	Navy and Air Force	2,033.50	429,929	4,200
Joint Standoff Weapon /Unitary (JSOW/Unitary)	Navy	5,608.30	661,013	7,800
Sense and Destroy Armor Munition (SADARM)	Army	2,937.40	35,063	73,612
Standoff Land Attack Missile-Expanded Response (SLAM-ER)	Navy	550.30	511,428	700 ^e
Tomahawk Baseline Improvement Program (TBIP)	Navy	2,578.60	1,552,000	1,181 ^e
Subtotal		28,213.56		174,446
Total		\$58,639.65		304,868

^aCost information and quantity are classified.

^bCost includes only production; development cost was not available.

^cAcquisition cost information for AGM-130C and EFOG-M includes developmental cost only. The Air Force does not plan to procure the AGM-130C and the 300 EFOG-Ms the Army plans to acquire are part of an advanced concept technology demonstration.

^dThe Air Force did not provide complete cost for the JDAM product improvement because the seeker technology has not been decided. However the Air Force has programmed \$76.5 million through fiscal year 2001 for the program. Also, quantities for the product improvement are not included in the total because 5,000 of the baseline JDAMs will be equipped with the terminal seeker.

^eQuantities for SLAM-ER and TBIP are not included in the total because these munitions are improvements and remanufacture of existing SLAMs and Tomahawks.

Appendix I
Precision Guided Munitions Acquisition

Table I.2: Platforms and Their PGM Types

Platform	PGM types
Air Force aircraft	
B-52	AGM-142, CALCM, GBU-10, GBU-12, Harpoon, JDAM, JDAM-PIP, SFW
B-1	JDAM, JDAM-PIP, JSOW/Baseline, JSOW/BLU-108, SFW
B-2	GAM, JDAM, JDAM-PIP, SFW
F-4	HARM, Maverick
F-15	AGM-130, GBU-10, GBU-12, GBU-15, GBU-24, GBU-28, JDAM, JDAM-PIP, JSOW/Baseline, JSOW/BLU-108, Maverick, SFW
F-16	GBU-10, GBU-12, GBU-24, HARM, JDAM, JDAM-PIP, JSOW/ Baseline, JSOW/BLU-108, Maverick, SFW
F-22	JDAM
F-111	AGM-130, GBU-10, GBU-12, GBU-15, GBU-28, SFW
F-117	GBU-10, GBU-12, GBU-27, JDAM, JDAM-PIP
A-10	GBU-10, GBU-12, GBU-24, Maverick, SFW
Navy aircraft	
F/A-18	GBU-10, GBU-12, GBU-24, HARM, Harpoon, JDAM, JSOW/Baseline, JSOW/BLU-108, JSOW/Unitary, Maverick, SLAM, SLAM-ER, Walleye
F-14	JDAM, GBU-10, GBU-12, GBU-24
AV-8	JDAM, JSOW/Baseline, JSOW/BLU-108, JSOW/Unitary, Maverick
A-6	GBU-10, GBU-12, GBU-24, HARM, Harpoon, Maverick, SLAM, SLAM-ER, Walleye
A-7	GBU-10, GBU-12, Maverick
P-3	Harpoon, JDAM, JSOW/Baseline, JSOW/BLU-108, JSOW/Unitary, Maverick
S-3	Harpoon, JDAM, JSOW/Baseline, JSOW/BLU-108, JSOW/Unitary
SH-60	Penguin
Navy ships	Harpoon, TASM, TLAM/C/D, TBIP
Navy submarines	TASM, TLAM/C/D, TBIP
Army weapons/vehicles	
155-mm Howitzer	SADARM
MLRS	ATACMS Block IA, ATACMS Block II/BAT/ BAT P ³ _I , ATACMS Block IIA/BAT P ³ _I
HMMWV	EFOG-M

PGM Target Options

The services have multiple options for countering targets in the five target classes. In addition to having different munitions to attack the same target classes, many munitions have capabilities against more than one target class.

To illustrate the services' options, the Air Force could use either the Maverick missile or guided bomb units (GBU) 10, 12, 24, or 27—already in inventory—to attack targets in the mobile hard target class. In addition, the Air Force is now producing the Sensor Fuzed Weapon, which is also used to attack armored vehicles. The Navy could use either the Maverick missile or Walleye bomb in its inventory to attack mobile armor targets. For additional capability to counter targets in this class, the Air Force is developing the JDAM and its improvement and an interim munition for the B-2, the Global Positioning System Aided Munition; the Navy is developing the JSOW with an antiarmor submunition (BLU-108); the Army is developing the Army Tactical Missile (ATACMS) with the Brilliant Antiarmor Submunition (BAT) and improvements to ATACMS and BAT, the Sense and Destroy Armor Munition (SADARM) and the Enhanced Fiber Optic Guided Missile (EFOG-M). Table I.3 provides a summary of the services' options by target class.

Appendix I
Precision Guided Munitions Acquisition

Table I.3: Munition Options by Target Classes

Target class	Inventory	Production	Development
Mobile hard	Maverick GBU-10 GBU-12 GBU-24 GBU-27 Walleye	SFW	ATACMS Block II/BAT/BAT P ³ _I ATACMS Block IIA/BAT P ³ _I EFOG-M GAM JDAM JDAM Product Improvement JSOW/BLU-108 SADARM
Mobile soft	Maverick GBU-15	AGM-142 SFW TLAM	ATACMS Block IA/APAM ATACMS Block II/BAT/ BAT P ³ _I ATACMS Block IIA/BAT PI GAM JDAM JDAM Product Improvement JSOW/Baseline JSOW/BLU-108
Fixed hard	Maverick GBU-10 GBU-12 GBU-15 GBU-24 GBU-27 Walleye	AGM-130 AGM-142 GBU-28 TLAM SLAM	GAM JDAM JDAM Product Improvement JSOW/Unitary SLAM-ER TBIP
Fixed soft	Maverick CALCM GBU-10 GBU-12 GBU-15 GBU-24 GBU-27 HARM Walleye	AGM-130 AGM-142 TLAM SLAM	ATACMS Block IA/APAM ATACMS Block IIA/BAT P ³ _I GAM JDAM JDAM Product Improvement JSOW/Baseline JSOW/Unitary SLAM-ER TBIP
Maritime surface	Maverick Harpoon Penguin TASM Walleye	AGM-142 SLAM	GAM JDAM JSOW/Unitary SLAM-ER TBIP

Precision Guided Munitions Fact Sheets

The fact sheets provide information about the munitions we reviewed. They are arranged in alphabetical order. An introductory paragraph briefly describes the munition and specific program information is provided in a summary format. Several munitions have multiple configurations that we combined under their common name. For example, the three Tomahawk configurations—the Tomahawk Anti-Ship Missile, the Tomahawk Land Attack Missile, and the Tomahawk Baseline Improvement Program—are all found in the section entitled “Tomahawk.”

Rather than listing specific targets for each munition, we have listed generic targets described in the Conventional Munitions Master Plan. Mobile hard targets include tanks, artillery, and armored personnel carriers; mobile soft targets include trucks, vans, mobile missile launchers, unprotected personnel, and motorized transport vehicles. Fixed hard targets include bridges, port facilities, hardened aircraft shelters, underground command posts, and bunkers; fixed soft targets include factories and manufacturing sites, general purpose buildings, roads, and rail yards. Maritime surface targets are ships at sea.

All development, production and total acquisition costs are in then-year dollars. Acquisition and production unit costs are averages of the totals reported.

Air-to-Ground Guided Missile-130

The Air-to-Ground Guided Missile-130 (AGM-130) is a powered version of the Guided Bomb Unit-15 munition. The munition allows the aircraft to remain at a distance from the target and uses man-in-the-loop guidance with either a television or infrared seeker and a 2,000-pound general purpose warhead. A further improvement, AGM-130C, developed, but not produced by the Air Force, adapts the munition to a 2,000-pound penetrating warhead.

Program Data

Service	Air Force
Program status	Production
Mission	Offensive counter air, close air support/interdiction, suppression of enemy air defenses, naval anti-surface warfare
Targets	Fixed hard, fixed soft
Platforms	F-15E, F-111
First capability	1994
Guidance method	TV and infrared
Range	Greater than 15 nautical miles
Quantity ^a	502
Development cost ^b	\$192.048 million
Production cost	\$443.908 million
Total acquisition cost	\$647.47 million
Acquisition unit cost	\$1.27 million
Production unit cost ^a	\$884,279

^aThe Air Force had planned to buy about 4,048 kits. However, that number was reduced to about 2,300 units and for fiscal year 1995 was further reduced to 502. The Air Force never awarded a full-rate production contract and the production unit cost of the munition rose from an estimated \$261,500 to \$884,279.

^bThe cost is for the AGM-130 only. Air Force reports development cost for the AGM-130C at \$11.513 million. We did not provide a separate fact sheet for the improvement because the Air Force did not indicate plans to extend development or procure hardware.

Air-to-Ground Guided Missile-142

The Air-to-Ground Guided Missile-142 (AGM-142), also known as Have Nap, provides the Air Force with a precision man-in-the-loop capability for the B-52H to attack high value, fixed targets from standoff ranges. The munition's data link provides for single aircraft operation or the munition's guidance may be turned over to a second aircraft allowing the first aircraft to leave the area. The Israeli-developed AGM-142 can be configured with a 750-pound blast fragmentation or a 770-pound penetration warhead. The munition uses either a television or imaging infrared seeker.

Program Data

Service	Air Force
Program status	Production
Missions	Offensive counterair, interdiction, suppression enemy air defense, naval anti-surface warfare
Targets	Mobile soft, fixed hard, fixed soft, maritime surface
Platforms	B-52H
First capability	1992
Guidance method	Television and imaging infrared (man-in-the-loop)
Range	Greater than 15 nautical miles
Quantity	130
Development cost	\$67.6 million
Production cost	\$133.1 million
Total acquisition cost	\$200.7 million
Acquisition unit cost	\$1.54 million
Production unit cost	\$1.02 million

Army Tactical Missile System

The Army Tactical Missile System (ATACMS) is the Army's deep fire system to provide a nearly all-weather, day or night, precision strike capability. The Army is developing three ATACMS variants that use the Global Positioning System (GPS). Another variant is already in production but does not have GPS guidance. Each variant in development will deploy submunitions. ATACMS is launched from the Multiple Launch Rocket System (MLRS) M270 launcher.

ATACMS Block IA/ Anti-Personnel, Anti-Materiel

This version of the ATACMS system provides an extended range capability by reducing the number of anti-personnel/anti-materiel submunitions from approximately 900 to approximately 275 and incorporating GPS components to aid the Inertial Navigation System (INS).

Program Data

Service	Army
Program status	Development
Mission	Interdiction
Targets	Mobile soft, fixed soft
Platform	MLRS M270 launcher
First capability	1998
Guidance method	GPS/INS
Range	Greater than 15 nautical miles
Quantity	800
Development cost	\$96.3 million
Production cost	\$732.0 million
Total acquisition cost	\$828.3 million
Acquisition unit cost	\$1.04 million
Production unit cost	\$915,000

ATACMS Block II/Brilliant Antiarmor Submunition

This version of the ATACMS provides an anti-armor capability for the missile by integrating 13 Brilliant Antiarmor submunitions (BAT) into the missile warhead. BAT is a brilliant, self-guided, anti-armor, top attack submunition with acoustic and infrared seekers working together to acquire, track, and home on operating armored vehicles. BAT submunitions can be carried deep into enemy territory by the delivery vehicle, then dispersed over numerous targets to attack and destroy them. About 6,000 BATs are expected to be the basic variant with acoustic and infrared sensors. The remainder are expected to have an improved version with acoustic, infrared, and millimeter wave sensors.

Program Data

Service	Army
Program status	Development
Mission	Control and shape the battlefield for the ground commander through deep anti-armor fires that delay, disrupt, and destroy moving targets.
Targets	Mobile hard, mobile soft
Platform	MLRS M270 launcher
First capability	2001
Guidance method	Missile—GPS/INS; submunition—acoustic and infrared or acoustic, infrared, and millimeter wave sensors
Range	Greater than 15 nautical miles
Quantity	Missiles—1,206; submunitions—16,170
Development cost	\$1,327.5 million
Production cost	\$2,651.8 million
Total acquisition cost	\$3,979.3 million
Acquisition unit cost	\$3.3 million
Production unit cost	\$2.2 million

ATACMS Block IIA/ Brilliant Antiarmor Submunition Product Improvement

This ATACMS Block IIA configuration will deliver a reduced payload of six improved BAT submunitions to an extended range. The Army plans to add a millimeter wave capability to the seeker assembly and improve the submunition warhead for attack of cold, stationary tanks and targets such as mobile missile launchers. The improvement program is being conducted concurrently with the engineering and manufacturing development program for the basic variant.

Program Data

Service	Army
Program status	Development
Mission	Interdiction
Targets	Fixed soft, mobile hard, mobile soft
Platform	MLRS M270 launcher
First capability	2003
Guidance method	Missile—GPS/INS; submunition—acoustic, imaging infrared, millimeter wave
Range	Greater than 60 nautical miles
Quantity	Missiles—600; submunitions—3,732
Development cost	\$425.0 million
Production cost	\$887.4 million
Total acquisition cost	\$1,312.4 million
Acquisition unit cost	\$2.19 million
Production unit cost	\$1.48 million

Conventional Air-Launched Cruise Missile

The Conventional Air-Launched Cruise Missile (CALCM) is deployed on the B-52H and was used during Operation Desert Storm. It provides the Air Force with a capability for attack of soft targets while the aircraft remains outside of threat defenses. The missile uses a conventional blast fragmentation warhead.

Program Data

Service	Air Force
Program status	Inventory
Mission	Offensive counterair, interdiction, suppression of enemy air defense
Targets	Fixed soft
Platform	B-52H
First capability	1987
Guidance method ^a	
Range	Greater than 350 nautical miles
Circular error probable ^a	
Quantity ^a	
Development cost ^a	
Production cost ^a	
Total acquisition cost ^a	
Acquisition unit cost ^a	
Production unit cost ^a	

^aThis information is classified.

Enhanced Fiber Optic Guided Missile

The Enhanced Fiber Optic Guided Missile (EFOG-M) system includes a gunner's station, launcher, and the tactical missile. The system uses a fiber optic data link that allows a human to view what the missile seeker sees and provide guidance commands. The missile launcher is to be mounted on a heavy high-mobility multi-purpose wheeled vehicle. EFOG-M is being developed as an advanced concept technology demonstration. Accordingly, the Army has no plans to produce the system once development is completed. A contract for the development and purchase of the demonstration equipment was awarded in May 1995. Following the demonstration program, the remaining equipment is to be turned over to an Army unit for a 2-year user evaluation.

Program Data

Service	Army
Program status	Development
Mission	To engage and defeat targets that may be masked from line-of-sight direct fire weapons.
Targets	Mobile hard
Platform	Heavy high-mobility multi-purpose wheeled vehicle
First capability	1999-2000 (2-year user evaluation)
Guidance method	GPS/INS; fiber optic man-in-the-loop
Range	15 kilometers
Circular error probable	0.5 meters
Quantity	300 missiles; 16 ground units
Development cost	\$289.7 million
Production cost	No production planned
Total acquisition cost	\$289.7 million
Acquisition unit cost	Not applicable
Production unit cost	Not applicable

Global Positioning System Aided Munition

The Global Positioning System Aided Munition (GAM) is being developed by the Air Force and Northrop Grumman Corporation as an interim precision munition for the B-2. The munition is to be replaced on the B-2 by the Joint Direct Attack Munition. GAM is a tail kit that will fit on the 2,000-pound general purpose bomb. GAM uses GPS guidance to more accurately guide to target locations.

Program Data

Service	Air Force
Program status	Development
Mission	Close air support, air interdiction, counterair, airborne strike, suppression of enemy air defense
Targets	Mobile hard, mobile soft, fixed hard, fixed soft, maritime surface
Platforms	B-2
First capability	1996
Guidance method	GPS/INS
Range	Greater than 5 nautical miles
Circular error probable	12-18 meters
Quantity	128
Development cost	Munition development cost is included with development of the GPS Aided Targeting System
Production cost	\$29.6 million
Total acquisition cost	\$29.6 million
Acquisition unit cost	\$231,250
Production unit cost	\$231,250

Guided Bomb Unit-10

The Guided Bomb Unit-10 (GBU-10) utilizes the 2,000-pound general purpose or penetrating warhead. The operator illuminates a target with a laser designator and then the munition guides to a spot of laser energy reflected from the target. The munition was used during Operation Desert Storm, and, according to the Air Force, hit 78 percent of its targets.

Program Data

Service	Air Force, Navy
Program status	Inventory
Mission	Air interdiction
Targets	Mobile hard, fixed soft, fixed hard
Platforms	A-7, A-10, B-52, F-111, F-117, F-15E, F-16, F/A-18 C/D, A-6, F-14
First capability	1976
Guidance method	Laser (man-in-the-loop)
Range	8 nautical miles
Circular error probable	9 meters
Quantity	Air Force: 10,145; Navy: 1,184
Development cost ^a	
Production cost	Air Force: \$240.436 million; Navy: \$30.902 million
Total acquisition cost	Not available
Acquisition unit cost	Not available
Production unit cost	Air Force: \$23,700 ; Navy: \$26,100

^aAir Force officials stated that they could not provide development cost for the munition because they do not have records covering the development period.

Guided Bomb Unit-12

The Guided Bomb Unit-12 (GBU-12) utilizes a 500-pound general purpose warhead. The operator illuminates a target with a laser designator and then the munition guides to a spot of laser energy reflected from the target. The munition was used during Operation Desert Storm, and, according to the Air Force, hit 88 percent of its targets.

Program Data

Service	Air Force, Navy
Program status	Inventory
Mission	Air interdiction
Targets	Mobile hard, fixed soft, fixed hard
Platforms	A-7, A-10, B-52, F-111, F-117, F-15, F-16, F/A-18 C/D, F-14, A-6
First capability	1976
Guidance method	Laser (man-in-the-loop)
Range	8 nautical miles
Circular error probable	9 meters
Quantity	Air Force: 29,654 ; Navy: 2,982
Development cost ^a	
Production cost	Air Force: \$563.426 million; Navy: \$56.807 million
Total acquisition cost	Not available
Acquisition unit cost	Not available
Production unit cost	Air Force: \$19,000; Navy: \$19,050

^aAir Force officials stated that they could not provide development cost because they do not have records covering the development period.

Guided Bomb Unit-15

The Guided Bomb Unit-15 (GBU-15) utilizes either a 2,000-pound general purpose or 2,000-pound penetrating warhead. The GBU-15 allows the aircraft to launch the munition from outside direct attack ranges, thus enhancing the survivability of the aircraft. The weapon has a television or infrared seeker data link with man-in-the-loop guidance.

Program Data

Service	Air Force
Program status	Inventory
Mission	Offensive counter air, close air support, interdiction, naval anti-surface warfare
Targets	Mobile soft, fixed hard, fixed soft
Platforms	F-15E, F-111
First capability	1985
Guidance method	Mid-course guidance-data link
Range	Greater than 5 nautical miles
Quantity	2,823
Development cost	\$188.3 million
Production cost	\$586.2 million
Total acquisition cost	\$774.5 million
Acquisition unit cost	\$274,354
Production unit cost	\$207,651

Guided Bomb Unit-24

The Guided Bomb Unit-24 (GBU-24) utilizes a 2,000-pound general purpose or penetrator warhead. The operator illuminates a target with a laser designator and then the munition guides to a spot of laser energy reflected from the target. The GBU-24 is similar to the GBU-10, but it has improved electronics and a larger aerodynamic flight surface that allows the munition to be launched from a lower altitude and from a greater distance from the target. The GBU-24 has low-level, standoff capability of more than 10 nautical miles.

Program Data

Service	Air Force, Navy
Program status	Inventory
Mission	Close air support, interdiction, offensive counter air, naval anti-surface warfare
Targets	Mobile hard, fixed soft, fixed hard
Platforms	A-10, F-111, F-15, F-16, F/A-18, F-14, A-6
First capability	1983
Guidance method	Laser (man-in-the-loop)
Range	Greater than 10 nautical miles
Quantity	13,114
Development cost ^a	Not available
Production cost	\$729.138 million
Total acquisition cost	Not available
Acquisition unit cost	Not available
Production unit cost	\$55,600

^aAir Force officials stated that development cost was not available because they do not have records covering the development period.

Guided Bomb Unit-27

The Guided Bomb Unit-27 (GBU-27) is a GBU-24 modified for delivery by the F-117 stealth fighter. The operator illuminates a target with a laser designator and then the munition guides to a spot of laser energy reflected from the target. It uses a 2,000-pound penetrating warhead against hard targets. The GBU-27 was used in Operation Desert Storm. According to the Air Force, the GBU-27 hit 70 percent of its targets.

Program Data

Service	Air Force
Program status	Inventory
Mission	Close air support, interdiction, offensive counter air, naval anti-surface warfare
Targets	Mobile hard, fixed hard, fixed soft
Platform	F-117
First capability	1987
Guidance method	Laser (man-in-the-loop)
Range	Greater than 10 nautical miles
Quantity	3,213
Development cost ^a	Not available
Production cost	\$176.715 million
Total acquisition cost	Not available
Acquisition unit cost	Not available
Production unit cost	\$55,000

^aAir Force officials stated that development cost was not available because they do not have records covering the development period.

Guided Bomb Unit-28

The Guided Bomb Unit-28 (GBU-28) is a 5,000-pound laser-guided conventional munition that uses a 4,400-pound penetrating warhead. The operator illuminates a target with a laser designator and then the munition guides to a spot of laser energy reflected from the target. The Air Force produced a limited quantity of the GBU-28 during Operation Desert Storm to attack multi-layered, hardened underground targets. After Operation Desert Storm, the Air Force incorporated some modifications, and further tested the munition.

Program Data

Service	Air Force
Program status	Production
Mission	Offensive counter air, close air support, interdiction
Targets	Fixed hard
Platforms	F-15E, F-111F
First capability	1991
Guidance method	Laser (man-in-the-loop)
Range	Greater than 5 nautical miles
Quantity	125
Development cost ^a	
Production cost	\$18.2 million
Total cost	\$18.2 million
Acquisition unit cost	\$145,600
Production unit cost	\$145,600

^aDevelopment cost is not applicable to this munition.

High-Speed Anti-Radiation Missile

The High-Speed Anti-Radiation Missile (HARM) suppresses or destroys land or sea-based radar emitters that direct enemy air defense systems. The Navy developed HARM; the Air Force also uses the missile.

Program Data

Service	Navy and Air Force
Program status	Inventory
Mission	Defense suppression
Targets	Fixed soft
Platforms	F/A-18, A-6E, F-4G, F-16
First capability	1983
Guidance method	Homes on electronic emissions
Range	Greater than 15 nautical miles
Quantity	19,607 (Navy and Air Force)
Development cost	\$644.5 million
Production cost	\$5,568.1 million
Total acquisition cost	\$6,212.6 million
Acquisition unit cost	\$316,856
Production unit cost	\$283,985

Harpoon

The Harpoon missile provides the Navy and the Air Force with a common missile for air, ship, and submarine launches. The weapon system uses mid-course guidance with a radar seeker to attack surface ships.

Program Data

Service	Navy and Air Force
Program status	Inventory
Mission	Maritime ship attack
Targets	Maritime surface
Platforms	A-6, F/A-18, S-3, P-3, B-52H, ships
First capability	1977
Guidance method	Radar seeker with mid-course guidance
Range	Greater than 60 nautical miles
Quantity	Navy: 5,983; Air Force: 90
Development cost	\$320.7 million
Production cost	\$2,882.3 million
Total acquisition cost	\$3,203.0 million
Acquisition unit cost	\$527,416
Production unit cost	\$474,609

Joint Direct Attack Munition

The Joint Direct Attack Munition (JDAM) is a joint Air Force and Navy program with the Air Force as the lead service. The JDAM will upgrade the existing inventory of general purpose and penetrator unitary bombs and a product improvement may add a terminal seeker to improve accuracy.

Joint Direct Attack Munition

The JDAM will upgrade the existing inventory of 1,000- and 2,000-pound general purpose unitary bombs and the 2,000-pound hard target penetrator bomb by integrating a guidance kit consisting of a GPS aided INS. JDAM is not intended to replace any existing weapon system; rather, it is to provide accurate delivery of general purpose bombs in adverse weather conditions.

Program Data

Service	Air Force and Navy
Program status	Development
Mission	Close air support, interdiction, offensive counterair, suppression of enemy air defense, naval anti-surface warfare, amphibious strike
Targets	Mobile hard, mobile soft, fixed hard, fixed soft, maritime surface
Platforms	B-52, B-1, B-2, F-22, F-16, F-15E, F-117, F-14 A/B/D, F/A-18C/D, F/A-18E/F, AV-8B, P-3, S-3
First capability	1997
Guidance method	GPS/INS (autonomous)
Range	Greater than 5 nautical miles
Circular error probable	13 meters
Quantity	Navy: 12,000; Air Force: 62,000
Development cost	\$496.2 million
Production cost	\$4,154.4 million
Total cost	\$4,650.6 million
Acquisition unit cost	\$62,846
Production unit cost	\$56,141

Joint Direct Attack Munition Product Improvement Program

The JDAM product improvement program may add a terminal seeker for precision guidance and other system improvements to existing JDAMS to provide the Air Force with 3-meter precision and improved anti-jamming capability. The Air Force is evaluating several alternatives and estimates that the seeker could be available for operations by 2004. The seeker kit could be used by both the 2,000-pound blast fragmentation and penetrator JDAMS.

Program Data

Service	Air Force
Program status	Development
Mission	Close air support, interdiction, offensive counterair, suppression of enemy air defense, naval anti-surface warfare, amphibious strike
Targets	Fixed hard, fixed soft, mobile hard, mobile soft
First capability	2004
Platforms	B-52, B-1, B-2, F-16, F-15E, F-117
Guidance method	GPS/INS mid-course with a terminal seeker yet to be selected
Range	Greater than 5 nautical miles
Circular error probable	3 meters
Quantity	5,000—kits to be added to basic JDAM
Development cost ^a	
Production cost ^a	
Total cost ^a	
Acquisition unit cost ^a	
Production unit cost ^a	

^aAir Force officials stated that the Air Force has not completed evaluation of the seeker technologies and therefore cannot determine the total cost of the product improvement. However, the Air Force has programmed about \$76.5 million for development through 2001.

Joint Standoff Weapon

The Joint Standoff Weapon (JSOW), formerly the Advanced Interdiction Weapon System, is a joint Navy and Air Force program with the Navy as the lead service. JSOW, a family of unpowered air-to-ground weapons, utilizes a global position system targeting capability and an efficient aerodynamic airframe to allow aircraft to standoff outside defenses. The Navy and Air Force are developing three JSOW configurations: (1) JSOW Baseline with combined effects submunitions for soft and area targets, (2) JSOW/BLU-108 with the submunitions used in the Sensor Fuzed Weapon (SFW) for massed land combat vehicles, and (3) JSOW/Unitary, a pre-planned product improvement with a unitary warhead and an autonomous or man-in-the-loop terminal seeker for use against fixed hard and soft and maritime surface targets.

The JSOW Baseline and Unitary are intended to replace a number of missile and guided bomb munitions included in this review. These include the Walleye, laser guided bombs (GBU-10, GBU-12, and GBU-24), and the Maverick. The JSOW/BLU-108 does not replace any existing PGMS.

Joint Standoff Weapon Baseline

The JSOW Baseline consists of the JSOW airframe and 145 combined effects submunitions. The JSOW airframe provides standoff and accurate delivery for targets dispersed over a wide area and other targets sensitive to blast and damage from fragments.

Program Data

Service	Navy and Air Force
Program status	Development
Mission	Close air support, interdiction, amphibious strike and anti-surface warfare
Targets	Mobile soft, fixed soft
Platforms	B-1, F-16, F-15E, F/A-18C/D, F/A-18E/F, AV-8B, P-3, S-3
First capability	1998
Guidance method	GPS/INS
Range	Greater than 15 nautical miles at low altitude; greater than 40 nautical miles at high altitude
Quantity	Navy: 8,800; Air Force: 3,000
Development cost	\$417.9 million
Production cost	\$2,909.7 million
Total acquisition cost	\$3,327.6 million
Acquisition unit cost	\$282,000
Production unit cost	\$246,585

Joint Standoff Weapon/BLU-108

The JSOW/BLU-108 consists of the JSOW carrier and six BLU-108 submunitions. The airframe provides standoff launch and accurate delivery for low altitude release of the submunitions. The submunitions are the same as those used in the Sensor Fuzed Weapon. Each submunition houses four projectiles; each projectile contains an explosively-formed penetrator warhead and a two-color infrared sensor.

Program Data

Service	Navy and Air Force
Program status	Development
Mission	Close air support, interdiction, amphibious strike and anti-surface warfare
Targets	Mobile hard, mobile soft
Platforms	B-1, F-16 C/D, F-15E, F/A-18C/D, F/A-18E/F, AV-8B, P-3, S-3
First capability	2001
Guidance method	JSOW airframe—GPS/INS BLU-108 submunitions—two-color infrared sensors
Range	Greater than 15 nautical miles at low altitude; greater than 40 nautical miles at high altitude
Quantity	Navy: 1,200; Air Force: 3,000
Development cost	\$227.8 million
Production cost	\$1,805.7 million
Total acquisition cost	\$2,033.5 million
Acquisition unit cost	\$484,167
Production unit cost	\$429,929

Joint Standoff Weapon/Unitary

The JSOW/Unitary builds on the JSOW Baseline by incorporating an autonomous terminal seeker, a man-in-the-loop data link, and a unitary warhead. These improvements are expected to provide increased accuracy and lethality, and the capability for aimpoint selection, target discrimination, and bomb impact assessment.

Program Data

Service	Navy
Program status	Development
Mission	Close air support, interdiction, amphibious strike and anti-surface warfare
Targets	Fixed hard, maritime surface
Platforms	F/A-18C/D, F/A-18E/F, AV-8B, P-3, S-3
First capability	2002
Guidance method	GPS/INS with a terminal seeker and man-in-the-loop data link
Range	Greater than 15 nautical miles at low altitude; greater than 40 nautical miles at high altitude
Quantity	7,800
Development cost	\$452.4 million
Production cost	\$5,155.9 million
Total acquisition cost	\$5,608.3 million
Acquisition unit cost	\$719,012
Production unit cost	\$661,013

Maverick

The Maverick utilizes either a 125-pound shaped-charge or 300-pound blast fragmentation warhead; its primary targets include armored vehicles, especially tanks. The Maverick variants include electro-optical/television (A and B), imaging infrared (D, F, and G), or laser guidance (E). The Air Force developed the Maverick, and the Navy procured the imaging infrared and the laser guided versions. Maverick was used during Operation Desert Storm and, according to the Air Force, hit 85 percent of its targets.

Maverick, Air Force

The Air Force uses two variants of the infrared Maverick. The D variant has a shaped charge warhead for attack of armored targets, while the G variant has a blast fragmentation warhead for attacking land targets.

Program Data

Service	Air Force
Program status	Inventory
Mission	Close air support, air interdiction, offensive counterair, strike
Targets	Mobile hard, mobile soft, fixed hard, fixed soft, and maritime surface
Platforms	A-7, A-10, F-4, F-16, F-15E
First capability	1986
Guidance method	Imaging infrared (D/G)
Range	12 nautical miles
Quantity	23,689
Development cost ^a	\$168 million
Production cost	\$2,895.5 million
Total acquisition	\$3,063.5 million
Acquisition unit	\$129,322
Production unit	\$122,230

^aThe Air Force reported quantities of 12,559 of the Maverick electro-optical/television variant. Cost information for this variant was not available.

Maverick, Navy

The Navy uses a laser and an imaging infrared variant of the Maverick. The laser variant homes on reflected laser energy from either a ground or airborne designator and carries a blast/penetration warhead. The imaging infrared variant carries a blast fragmentation warhead for attacking ships.

Program Data

Service	Navy
Program status	Inventory
Mission	Close air support, air interdiction, offensive counterair, strike, anti-surface warfare
Targets	Mobile hard, mobile soft, fixed hard, fixed soft, and maritime surface
Platforms	A-6, F-18, AV-8B, P-3
First capability	1986
Guidance method	Imaging infrared; laser
Range	12 nautical miles
Quantity	4,115
Development cost	\$25.5 million
Production cost	\$627.5 million
Total acquisition cost	\$653 million
Acquisition unit cost	\$158,688
Production unit cost	\$152,491

Penguin

Penguin was initially developed by the Norwegians as an anti-ship weapon for patrol boats. However, the missile has been modified for aircraft launch. The missile uses a programmed inertial navigation and an infrared terminal seeker. The target coordinates are delivered to the weapon using the launch aircraft radar. The weapon is autonomous, allowing the aircraft to break off immediately after launch. Penguin provides the Navy's SH-60B helicopters with an anti-ship capability.

Program Data

Service	Navy
Program status	Inventory
Mission	Anti-surface warfare
Targets	Maritime surface
Platforms	SH-60B helicopter
First capability	1994
Guidance method	Infrared seeker with mid-course guidance
Range	17 nautical miles
Quantity	101
Development cost	\$83.5 million
Production cost	\$158.2 million
Total acquisition cost	\$241.7 million
Acquisition unit cost	\$2.4 million
Production unit cost	\$1.57 million

Sense and Destroy Armor Muniton

The Sense and Destroy Armor Muniton (SADARM) is expected to provide capability against stationary, armored vehicles beyond the forward line of troops and enable rapid engagement, day or night despite degraded battlefield conditions. Two 5.8-inch diameter SADARMS are carried in a 155-millimeter projectile launched from a howitzer. The submunition has both millimeter wave and infrared sensing devices, electronics for information processing, and an explosively formed penetrator warhead.

Program Data

Service	Army
Program status	Development
Mission	Counterfire
Targets	Mobile hard
Platform	155-millimeter howitzer
First capability	1999
Guidance method	Active and passive millimeter wave and infrared
Range	22.5 kilometers
Quantity	Projectiles: 73,612; SADARM submunitions: 147,224
Development cost	\$356.3 million
Production cost	\$2,581.1 million
Total acquisition cost	\$2,937.4 million
Acquisition unit cost	\$39,904
Production unit cost	\$35,063

Sensor Fuzed Weapon

The Air Force's Sensor Fuzed Weapon (SFW) is a 1,000-pound, unpowered, multiple kill per pass munition. The SFW's tactical munitions dispenser houses 10 BLU-108 submunitions. Each submunition contains four projectiles, an orientation and stabilization system, a radar altimeter, and a rocket motor. Each projectile contains an explosively formed penetrator warhead and a two-color infrared sensor. If the projectile does not detect a target, it detonates after a fixed elapsed time, causing damage to material and personnel. Neither the munition dispenser nor the BLU-108 submunitions are guided. However, the projectiles scan a wide area with their infrared sensors searching for targets. The Air Force is also developing a tail kit, termed the Wind Corrected Munitions Dispenser, for the SFW and similar munitions that will provide inertial navigation and allow aircraft to deliver them from high altitudes.

Program Data

Service	Air Force
Program status	Production
Mission	Interdiction
Targets	Mobile hard, mobile soft
Platform	F-16, F-15E, F-111, A-10, B-52H, B-52
First capability	1995
Guidance method	Two color infrared sensor
Range	Direct attack
Quantity	5,000
Development cost	\$227.7 million
Production cost	\$1,599.4 million
Total acquisition cost	\$1,827.1 million
Acquisition unit cost	\$365,420
Production unit cost	\$319,880

Standoff Land Attack Missile

The Standoff Land Attack Missile (SLAM) is derived from the Harpoon missile and is designed to provide an intermediate range day/night/adverse weather air-to-surface weapon for use against land targets and surface ships in port. The Navy plans to improve performance by retrofitting SLAMs with a suite of improvements.

Baseline Standoff Land Attack Missile

SLAM combines an imaging infrared seeker, inertial GPS-aided guidance, and data link control to provide standoff precision strike against land targets and selective ship attack. The pilot can fine tune the aim point while the missile is in flight, providing targeting accuracy, real time bomb damage assessment, and minimum collateral damage.

Program Data

Service	Navy
Program status	Production
Mission	Anti-surface warfare, strike
Targets	Fixed hard, fixed soft, maritime surface
Platforms	F/A-18C/D, F/A-18E/F, A-6E
First capability	1991
Guidance method	Imaging infrared seeker, inertial GPS-aided guidance, and data link control
Range	Greater than 60 nautical miles
Quantity	767
Development cost	\$81.9 million
Production cost	\$1,056.9 million
Total acquisition cost	\$1,138.8 million
Acquisition unit cost	\$1.49 million
Production unit cost	\$1.38 million

Standoff Land Attack Missile Expanded Response

The SLAM-Expanded Response (SLAM-ER) is an upgrade and retrofit to the baseline SLAM. It will maintain baseline SLAM capability while improving performance in the areas of launch and control, aircraft survivability, immunity to countermeasures and probability of kill against hardened targets. SLAM-ER is also expected to provide improved range, hard target penetration and user interfaces for both mission planning and aircraft integration.

Program Data

Service	Navy
Program status	Development
Mission	Anti-surface warfare, strike
Targets	Fixed hard, fixed soft, maritime surface
Platforms	F/A-18C/D/E/F, A-6 and potentially: B-52, B-1, B-2, F-16, F-15E, F-117, F-14, AV-8B, P-3, S-3, V-22
First capability	1997
Guidance method	Imaging infrared seeker, inertial GPS-aided guidance, and man-in-the-loop data link control
Range	Greater than 60 nautical miles
Quantity	700
Development cost	\$192.3 million
Production cost	\$358.0 million
Total acquisition cost	\$550.3 million
Acquisition unit cost	\$786,143
Production unit cost	\$511,428

Tomahawk

The Navy has three conventional versions of the Tomahawk missile: Tomahawk Anti-Ship Missile (TASM), Tomahawk Land-Attack Missile (TLAM), and the developmental Tomahawk Baseline Improvement Program (TBIP).

Tomahawk Anti-Ship Missile

TASM attacks over-the-horizon, open ocean ships in a battle group. The TASM mission has receded because this variant is not particularly suited to warfare in waters that may be crowded with both combatant and noncombatant ships. The Navy plans to remanufacture the existing TASMs into TBIPs.

Program Data

Service	Navy
Program status	Inventory
Mission	Maritime ship attack
Targets	Ships
Platforms	Ships, submarines
First capability	1984
Guidance method	Mid-course guidance
Range	Greater than 60 nautical miles
Quantity	593
Development cost	\$346.9 million
Production cost	\$1,513.9 million
Total acquisition cost	\$1,860.8 million
Acquisition unit cost	\$3.14 million
Production unit cost	\$2.553 million

Tomahawk Land Attack Missile C/D

Tomahawk Land Attack Missile-C (TLAM-C) uses a unitary warhead and the Tomahawk Land Attack Missile-D (TLAM-D) uses a submunition warhead. TLAM-C generally attacks single, fixed targets such as a specific point on a building; TLAM-D attacks area-type targets such as aircraft parked on a ramp. The Tomahawk missile follows a pre-programmed route over specific terrain features using a combination of terrain contour matching and digital scene matching area correlation guidance.

Program Data

Service	Navy
Program status	Production
Mission	Close air support/interdiction, offensive counter air, suppression of enemy air defense, naval anti-surface warfare
Targets	Fixed soft, fixed hard, mobile soft
Platforms	Ships, submarines
First capability	TLAM-C/D Block II: 1986; Block III: 1993
Guidance method	Terrain Correlation Mapping, Digital Scene Matching Area Correlator
Range	Greater than 350 nautical miles
Quantity	TLAM-C: 2,729; TLAM-D: 676
Development cost	\$1,224.9 million
Production cost	\$7,201.9 million
Total acquisition cost	\$8,426.8 million
Acquisition unit cost	\$2.475 million
Production unit cost	\$2.115 million

Tomahawk Baseline Improvement Program

TBIP represents a major upgrade to the Tomahawk. TBIP uses (1) a jam-resistant GPS receiver and an INS to guide the missile throughout the mission and (2) a forward-looking terminal sensor to autonomously attack the target. The Navy plans to upgrade or remanufacture the existing TASM and the TLAM-C inventory to TBIP.

Program Data

Service	Navy
Program status	Development
Mission	Amphibious strike and anti-surface warfare, naval warfare support, naval warfare
Targets	Fixed hard, fixed soft, maritime surface
Platforms	Ships, submarines
First capability	2000
Guidance method	GPS/INS
Range	Greater than 350 nautical miles
Quantity	1,181
Development cost	\$745.7 million
Production cost	\$1,832.9 million
Total cost	\$2,578.6 million
Acquisition unit cost	\$2.18 million
Production unit cost	\$1.55 million

Walleye

Walleye is a television-guided munition that can be either autonomous, homing on a high contrast target; or the pilot can send guidance commands in-flight with a data link to update the aimpoint. Walleye has two warhead sizes, 415 pounds and 1,000 pounds, that can be used during daylight operations against a variety of fixed, mobile, or maritime targets. Walleye was used during Operation Desert Storm and, according to the Navy, achieved a success rate of 60 percent.

Program Data

Service	Navy
Program status	Inventory
Mission	Close air support, interdiction, offensive counter air, naval anti-surface warfare
Targets	Mobile hard, fixed hard, fixed soft, maritime surface
Platforms	A-6, F/A-18
First capability	1967; data link configuration—mid 1970s
Guidance method	TV data link and man-in-the-loop
Range	Greater than 15 nautical miles
Circular error probable	15 feet
Quantity	1,300 non-data link configuration; 1,900 data link configuration
Development cost	\$77 million
Production cost	\$295 million
Total acquisition cost	\$372 million
Acquisition unit cost	\$116,250
Production unit cost	\$92,188

Scope and Methodology

We identified 33 precision guided munitions that have some capability to alter their in-flight course to improve the chances of hitting a target. In selecting these munitions for review, we considered only munitions that are surface-to-surface, indirect fire weapons or are air-to-surface weapons. In addition, munitions included have a nominal standoff from their launching platform of about 5 nautical miles or more.

The 33 PGM types we reviewed included Army, Navy, and Air Force munitions in inventory that are no longer in production; munitions that have an open production line; and developmental munitions that have not yet begun production. Developmental munitions also include munition product improvements that are not yet being produced. The munitions selected are not the total universe of precision guided munitions but are those that, in our judgement, represented the substantial majority of the services' PGM investment and capability.

We reviewed the services' mission need and cost and operational effectiveness analyses for the developmental systems to determine the tradeoffs that the services had examined before approving munition development. We obtained program cost, schedule, and employment information for all 33 munitions in order to compare munitions capabilities with each other. We did not compare PGM capabilities with non-precision munitions. We interviewed Air Force, Navy, and Army personnel concerning requirements, acquisition, and platform integration and visited the following locations:

- Office of the Undersecretary of Defense, Acquisition and Technology, Office of Munitions, Washington, D.C.;
- Office of the Undersecretary of Defense, Program Analysis and Evaluation, Washington, D. C.;
- Naval Air Systems Command, Arlington, Virginia;
- Program Executive Office, Cruise Missiles and Unmanned Aerial Vehicles Joint Program Office, Arlington, Virginia;
- Air Force's Aeronautical Systems Center, Wright-Patterson Air Force Base, Ohio, and Eglin Air Force Base, Florida;
- Air Force's Air Combat Command, Langley Air Force Base, Virginia;
- Office of the Assistant Secretary of the Army for Research, Development and Acquisition, Washington, D.C.;
- Program Executive Office, Tactical Missiles, Redstone Arsenal, Alabama;
- Fire Support Armaments Center, Picatinny Arsenal, New Jersey; and
- U.S. Army Training and Doctrine Command, Ft. Monroe, Virginia.

Appendix III
Scope and Methodology

We also obtained documents on Air Force munitions in inventory from the Air Force Logistics Command, Hill Air Force Base, Utah, and Tinker Air Force Base, Oklahoma.

We performed our work from January 1994 to May 1995 in accordance with generally accepted government auditing standards.

Comments From the Department of Defense



OFFICE OF THE UNDER SECRETARY OF DEFENSE

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WASHINGTON DC 20301-3000



MAY 15 1995

Mr. Henry L. Hinton, Jr.
Assistant Comptroller General
National Security and International Affairs Division
U.S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Hinton:

This is the Department of Defense (DoD) response to the General Accounting Office (GAO) draft report, "WEAPONS ACQUISITION: Precision Guided Munitions in Inventory, Production, and Development", dated April 17, 1995 (GAO Code 707054/OSD Case 9906).

As the draft report does not present findings, conclusions, or recommendations, the DoD takes no position on the report but does note it as a contribution to the overall data base. Accordingly, I am forwarding for your consideration copies of the draft report that have been annotated with technical corrections.

I would like to comment that the scope of the draft report is broad. The weapons programs the report addresses span a time period from the Vietnam War into the 21st century. During this period budgets, priorities, missions, and threats all have seen change. Any conclusions drawn by comparison of various programs, to be valid, would have to be done carefully to reflect changing conditions.

George R. Schneider
Director
Strategic and Tactical Systems

Enclosure



See comment 1.

The following is GAO's comment on the Department of Defense's letter dated May 15, 1995.

GAO Comment

1. The technical corrections provided in the enclosure to the Department of Defense's comments consisted primarily of changes to cost and quantities since the completion of our fieldwork. We have revised the report to include these changes, where appropriate.

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